Feb. 20, 1951 J. E. HOLVECK ET AL 2,542,526

NOZZLE VALVE

Filed April 6, 1946

2 Sheets-Sheet 1

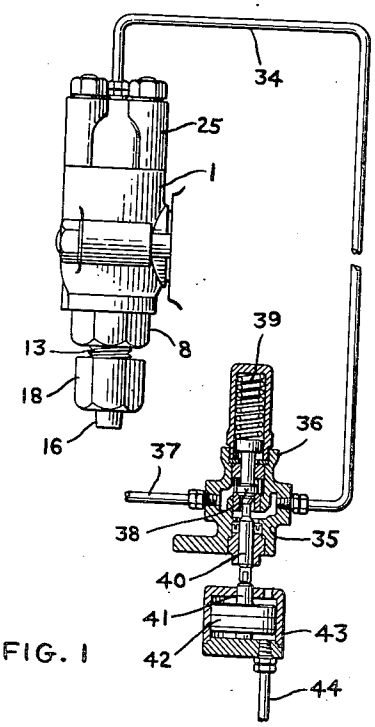


FIG. 1

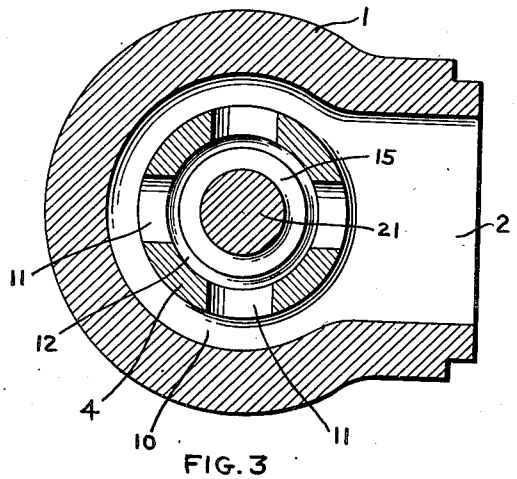


FIG. 3

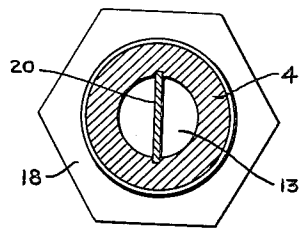


FIG. 4

JOSEPH E. HOLVECK
ARTHUR G. ROCKWOOD *INVENTORS*

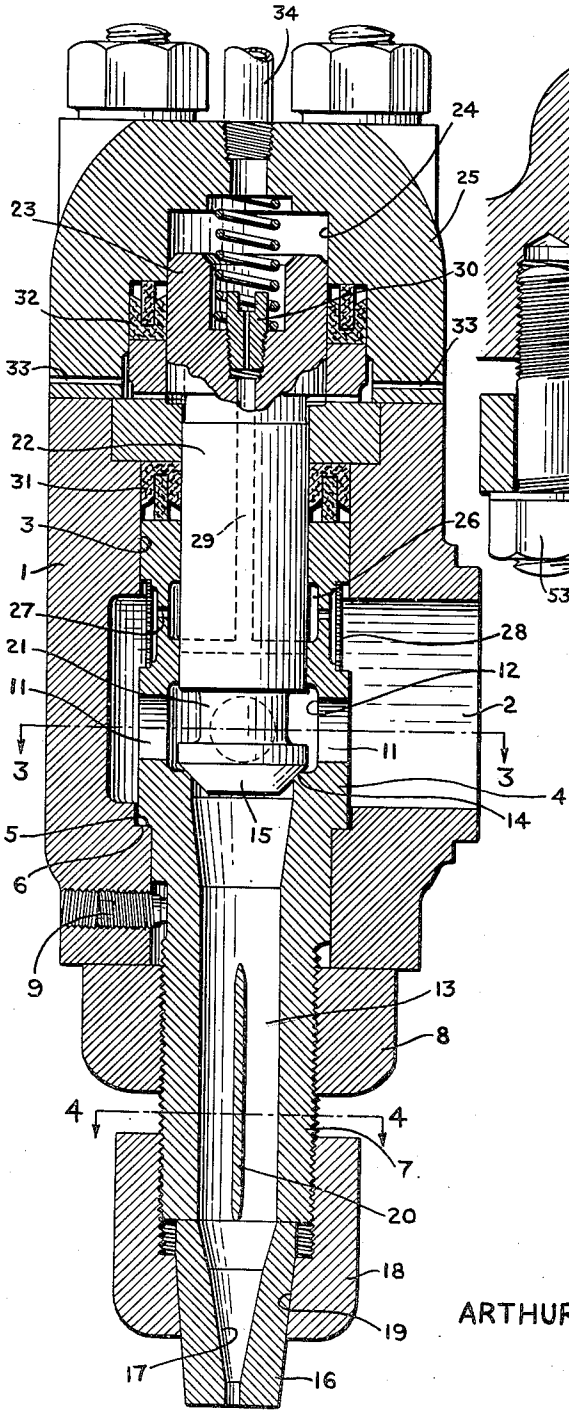
BY Robie Meyer
Attorney

Feb. 20, 1951 J. E. HOLVECK ET AL 2,542,526

NOZZLE VALVE

Filed April 6, 1946 2 Sheets-Sheet 2

FIG. 2



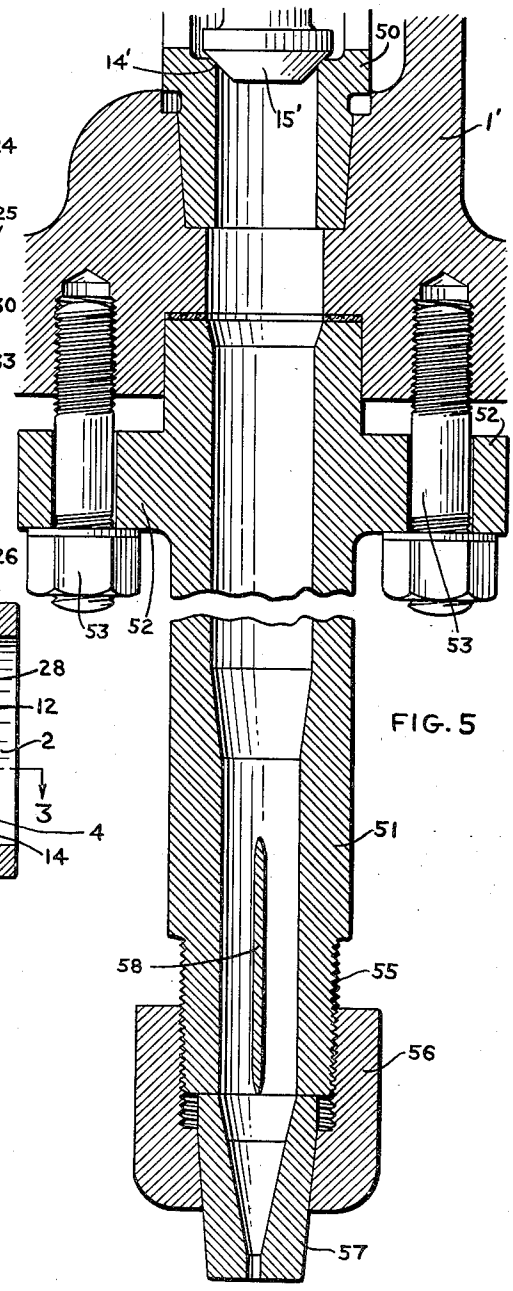


FIG. 5

JOSEPH E. HOLVECK
ARTHUR G. ROCKWOOD *INVENTORS*

BY Robert Meyer
Attorney

Patented Feb. 20, 1951

2,542,526

UNITED STATES PATENT OFFICE

2,542,526

NOZZLE VALVE

Joseph E. Holveck, Upper Montclair, and Arthur G. Rockwood, Nutley, N. J., assignors to Worthington Pump and Machinery Corporation, Harrison, N. J., a corporation of Delaware

Application April 6, 1946, Serial No. 660,048

4 Claims. (Cl. 137—139)

1

This invention relates to nozzles, and more particularly to high pressure—high velocity nozzles such as are employed in removing bark from logs, descaling steel billets, steel sheets, and like cleaning uses.

An object of the present invention is to provide a nozzle for projecting jets of high pressure—high velocity fluid, which nozzle combines in a single unitary structure, a control valve structure for controlling fluid flow through the nozzle, together with straight line flow of the fluid from the valve to the ejection opening of the nozzle.

Other objects of the present invention are to provide in a nozzle, as specified, means for operating the valve hydraulically by the same pressure fluid which is delivered to the nozzle; means for preventing slamming of the valve upon its seat; the provision of a removable or replaceable orifice member which controls the opening or closing of the valve; and to provide a nozzle structure as specified which is positive in its action and may be delicately and accurately controlled to perform its desired function.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a nozzle of a preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings:

Figure 1 is a side elevation of the improved nozzle showing a longitudinal sectional view of a control valve structure for controlling operation of the nozzle:

Figure 2 is a longitudinal section through the nozzle; and

Figure 3 is a horizontal section taken on the line 3—3 of Figure 2.

Figure 4 is a horizontal section taken on the line 4—4 of Figure 2.

Figure 5 is a fragmentary longitudinal section through a modified form of the nozzle.

Referring more particularly to the drawings, the improved nozzle structure comprises a body or housing 1 which has an inlet port 2 for the inlet of high pressure fluid formed in one side thereof and which body or housing 1 is provided with a longitudinal bore 3 which receives therein the valve cage 4. The valve cage 4 has an annular shoulder 5 formed thereon which abuts the annular shoulder 6 formed in the housing 1 and also has an elongated externally screw threaded flow

2

extension 7 formed on one end thereof. A clamping nut 8 is threaded on the flow extension 7 and engages the end of the housing 1 for clamping the shoulder 5 tightly against the shoulder 6, and the valve cage 4 is prevented from turning relative to the housing by a set screw 9.

As clearly shown in Figure 3 of the drawings the inlet port 2 opens into an annular passage 10 in the housing 1. The annular passage 10 has communication with the interior of the valve cage 4 through a plurality of openings 11 formed in the valve cage. The openings 11 open into an enlarged chamber section 12 of the bore of the valve cage 4, which in turn has communication with the out flow passage 13 in the flow extension 7. A valve seat 14 is formed at the junction of the chamber 12 with the flow passage 13 and a valve 15 co-operates with the valve seat 14 for controlling flow of high pressure fluid through the flow passage 13 and outwardly through the nozzle tip 16. The nozzle tip 16 is provided with a flow passage forming bore 17 of any desired shape to provide the desired shape and effect of the projected stream of high pressure fluid from the nozzle. The nozzle tip 16 is detachably connected to the flow extension 7 by a nut 18, which has a tapered bore 19 for clamping engagement with the tapered outer surface of the nozzle tip 16.

The high pressure fluid or water entering the chamber 12 through the ports or openings 11 in a direction transverse of its flow direction through the flow passage 13, and from the annular space 10 will have whirl components and will be in a turbulent state. A straightening vane 20 is located in the flow passage 13 to remove the whirl components and turbulence from the flowing stream of high pressure fluid and deliver the fluid in a straight line flow to the bore 17 of the nozzle tip 16. The straightening vane 20 is preferably streamline in shape and extends longitudinally in the flow passage 13 approximately at its longitudinal center.

The valve 15 is connected, by a reduced stem 21 to a piston 22 which is mounted for reciprocating movement in the valve cage 4, and the piston 22 has an enlarged head 23 which reciprocates in the bore 24 of the bonnet 25 of the housing 1.

The valve cage 4 has an annular chamber 26 formed therein about the piston 22, and this annular chamber 26 has communication with the annular space 10 to receive high pressure fluid therefrom through a plurality of ports 27. Screens 28 extend over the ports 27 to prevent any foreign matter from entering the ports 27.

The piston 22 has an inverted T-shaped passage 29 therein the ends of the cross line of which communicate with the annular chamber 26 while the stem of the passage extends longitudinally through the piston 22 and enlarged head 23, and opens out through a reduced orifice in the head 23 into the bore 24 outwardly of the outer end of the enlarged head 23. The reduced orifice is shown in the drawings as formed in a removable plug 30. The removable plug 30 is provided so that it may be replaced when the orifice therein becomes worn, or to permit use of different sized orifices at the outlet of the passage 29. Packing shown at 31 is positioned about the piston 22 and other packing shown at 32 is placed about the enlarged head 23 to retard leakage of pressure fluid past the piston 22 and enlarged head 23. However to prevent any leakage fluid which may pass the packings 31 and 32 from interfering with the operation of the structure bleed off passages 33 are provided in the bonnet 25 and open out to atmosphere as clearly shown in Figure 2 of the drawings.

The bonnet 25 has a pipe 34 connected thereto and opening into the bore 24, which pipe 34 is connected to and opens into the housing 35 of a pressure operated valve structure 36. A pipe 37 also has communication with the interior of the valve housing 35 and opens to waste or atmosphere. A piston valve 38 within the housing 35 controls fluid flow through the valve structure 36 and thus controls the communication of pipes 34 and 37. The valve 38 is urged on its seat by a spring 39, and it has a stem 40 attached thereto which extends out of the housing 36 and is engaged by the stem or rod 41 of a piston 42. The piston 42 reciprocates in a cylinder 43 and is operated by pressure fluid from any suitable source, which enters the cylinder 43 through the pipe 44 and moves the piston 42 to unseat the valve 38 to permit pressure fluid to bleed from the bore 24 of the bonnet 25, through the valve structure 36.

In operation, the valve 15 is operated by hydraulic pressure (i. e. the pressure of the water or fluid entering through the inlet 2) acting upon the piston 22 and enlarged piston head 23. It will be noted by reference to Figure 2 of the drawings that the piston 22 has a smaller area exposed to the action of the pressure fluid than the piston head 23 and a larger exposed area than the valve 15.

Constant pressure is maintained in the bore or cylinder in which the piston 22 reciprocates and in the chamber 12, since they are open to the inlet 2 and the source of pressure fluid supply (not shown) and are sealed off from atmosphere by the packing 31.

Intermittent pressure is maintained in the bore or cylinder 24, by opening and closing of the valve 38. When the valve 38 is closed pressure fluid from the inlet 2 flows through the chamber 26, inverted T-shaped passage 29 and restricted orifice 30 and is maintained in the bore or cylinder 24. This pressure fluid acting upon the larger area of the piston head 23 overbalances the pressure acting upon the smaller area of the piston 22 and keeps the valve 15 upon its seat 14, preventing the flow of the pressure fluid through the nozzle 16.

When the valve 38 is opened, the pressure in the bore or cylinder 24 becomes considerably less than the pressure in the chamber 12, due to the restricted flow of the pressure fluid through the orifice 30 and the unrestricted flow of the pressure fluid from the bore or cylinder 24 through

piping 34 and valve structure 36 to atmosphere or waste. This differential pressure causes the unbalanced force on the piston 22 to open or unseat the valve 15 and allow the water or fluid under pressure to flow through passage 13 and nozzle 16.

In Figure 5 of the drawings a modified form of the nozzle is shown. The modification of the nozzle structure shown in this Figure 5, deals only with the structure of the nozzle flow passage member and valve cage, being in all other respects of the same construction and arrangement, and manner of operation as the form of the nozzle shown in Figures 1 to 4 of the drawings. In the modified form shown in Figure 5 the valve cage 50 which carries the valve seat 14' and valve 15' terminates within the body 1' and the flow passage carrying member 51, which serves the function of the threaded extension 7 of Figure 2, is separate from the valve cage and is detachably connected to the body 1' by means of a flange 52 and bolts 53, so that it may be removed for replacement with a nozzle flow passage member either longer or shorter depending upon the service in which the nozzle is employed. A gasket 54 is provided to form a fluid seal between the flow passage member 51 and the body 1'.

The outer end of the flow passage member 51 is externally screw threaded as shown at 55 to receive a clamping nut 56 for clamping the nozzle tip 57 against the end of the flow passage member 51. A turbulence straightening vane 58 is also located in the passage formed in the flow passage member 51 and serves the same function as the vane 20 shown in Figures 2 and 4 of the drawings.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In a nozzle structure, flow control means comprising, a valve body, a valve cage removably carried by said valve body and having a valve seat therein, said valve cage having an outflow passage therein, a valve for contact with said valve seat, a piston and an enlarged piston head connected to said valve, said valve body and valve cage having pressure fluid receiving chambers therein whereby one end of the valve stem will be subject to pressure fluid to force the valve into open position, said valve cage provided with an annular chamber therein and with ports connecting the annular chamber to said pressure receiving chamber in said valve housing, said piston and piston head provided with ports and passages to bleed pressure fluid from said annular chamber through and behind said piston head to force said valve on its seat, said annular chamber and the ports into said bleed passage arranged whereby as said valve moves towards and onto its seat the portion of the valve cage adjacent said annular channel will act to throttle the flow of pressure fluid through said bleed passage but not completely close off communication of the passage with said annular chamber, said housing provided with a port to permit bleeding of pressure from behind said piston, and means to cut off bleeding of pressure fluid from behind said piston to cause seating of said valve.

2. In a nozzle structure, flow control means comprising, a valve body, a valve cage removably carried by said valve body and having a valve

seat therein, said valve cage having an outflow passage therein, a valve for contact with said valve seat, a piston and an enlarged piston head connected to said valve, said valve body and valve cage having pressure fluid receiving chambers therein whereby one end of the valve stem will be subject to pressure fluid to force the valve into open position, said valve cage provided with an annular chamber therein and with ports connecting the annular chamber to said pressure receiving chamber in said valve housing, said piston and piston head provided with ports and passages to bleed pressure fluid from said annular chamber through and behind said piston head to force said valve on its seat, said annular chamber and the ports into said bleed passage arranged whereby as said valve moves towards and onto its seat the portion of the valve cage adjacent said annular channel will act to throttle the flow of pressure fluid through said bleed passage but not completely close off communication of the passage with said annular chamber, said housing provided with a port to permit bleeding of pressure from behind said piston, means to cut off bleeding of pressure fluid from behind said piston to cause seating of said valve, and a restricted orifice forming plug in said passage to restrict flow of pressure fluid therethrough.

3. In a nozzle structure, flow control means comprising, a valve body, a valve cage removably carried by said valve body and having a valve seat therein, said valve cage having an outflow passage therein, a valve for contact with said valve seat, a piston and an enlarged piston head connected to said valve, said valve body and valve cage having pressure fluid receiving chambers therein whereby one end of the valve stem will be subject to pressure fluid to force the valve into open position, said valve cage provided with an annular chamber therein and with ports connecting the annular chamber to said pressure receiving chamber in said valve housing, said piston and piston head provided with ports and passages to bleed pressure fluid from said annular chamber through and behind said piston head to force said valve on its seat, said annular chamber and ports into said bleed passage arranged whereby as said valve moves towards and onto its seat the portion of the valve cage adjacent said annular channel will act to throttle the flow of pressure fluid through said bleed passage but not completely close off communication of the passage with said annular chamber, said housing

provided with a bleed-off leakage port to prevent leakage of pressure fluid past said piston and piston head from disrupting the pressure relation between the piston and piston head.

4. In a nozzle structure, flow control means comprising, a valve body, a valve cage removably carried by said valve body and having a valve seat therein, said valve cage having an outflow passage therein, a valve for contact with said valve seat, a piston and an enlarged piston head connected to said valve, said valve body and valve cage having pressure fluid receiving chambers therein whereby one end of the valve stem will be subject to pressure fluid to force the valve into open position, said valve cage provided with an annular chamber therein and with ports connecting the annular chamber to said pressure receiving chamber in said valve housing, said piston and piston head provided with ports and passages to bleed pressure fluid from said annular chamber through and behind said piston head to force said valve on its seat, said annular chamber and the ports into said bleed passage arranged whereby as said valve moves towards and onto its seat the portion of the valve cage adjacent said annular channel will act to throttle the flow of pressure fluid through said bleed passage but not completely close off communication of the passage with said annular chamber, said housing provided with a bleed-off leakage port to prevent leakage of pressure fluid past said piston and piston head from disrupting the pressure relation between the piston and piston head, and a spring in said valve body and engaging said piston head to cooperate with pressure fluid acting on the piston head to seat the valve.

JOSEPH E. HOLVECK.
ARTHUR G. ROCKWOOD.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
477,824	Robinson	June 28, 1892
597,842	Edmands	Jan. 25, 1898
1,046,236	Wagner	Dec. 3, 1912
1,147,639	Nolan	July 20, 1915
1,203,607	Gladding	Nov. 7, 1916
1,504,201	Anderson	Aug. 12, 1924
1,677,781	Joyner	July 17, 1928
2,329,001	Robinson	Sept. 7, 1943